



(86) 1994/07/15

(87) 1995/01/26

(45) 2001/04/10

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(51) Int.Cl.⁶ C10L 1/18

(30) 1993/07/16 (PM0004) AU

(54) MELANGES D'ESSENCE

(54) FUEL BLENDS

Drayton

(57) A fuel blend composition including a hydrocarbon liquid as defined, up to 20 % of the total composition of ethanol and/or n-propanol and up to 15 % by volume of the total composition of a fatty acid and/or organic ester.

PCTWORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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| (51) International Patent Classification ⁵: C10L 1/02, 1/10, 1/18 | A1 | (11) International Publication Number: WO 95/02654 (43) International Publication Date: 26 January 1995 (26.01.95) |
| (21) International Application Number: PCT/AU94/00401 (22) International Filing Date: 15 July 1994 (15.07.94) (30) Priority Data: PM0004 16 July 1993 (16.07.93) AU (71) Applicant (for all designated States except US): VICTORIAN CHEMICAL INTERNATIONAL PTY LTD [AU/AU]; A.C.N. 006 083 012, 37-49 Appleton Street, Richmond, VIC 3121 (AU). (72) Inventors; and (75) Inventors/Applicants (for US only): KILLICK, Robert, William [AU/AU]; 14 Dallas Street, Mount Waverley, VIC 3149 (AU). WRIGLEY, Peter, Ronald [AU/AU]; 28 Raleigh Street, Blackburn South, VIC 3130 (AU). PARNABY, Lawrence, Harold [AU/AU]; 20 Baratta Street, Blackburn South, VIC 3130 (AU). (74) Agent: FREEHILL PATENT & TRADE MARK SERVICES; Level 47, 101 Collins Street, Melbourne, VIC 3000 (AU). | | (81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, ES, FI, GB, GE, HU, JP, KE, KG, KP, KR, KZ, LK, LT, LU, LV, MD, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SI, SK, TJ, TT, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD). Published <i>With international search report.</i> <div style="text-align: center; font-size: 2em;">2167294</div> |
| (54) Title: FUEL BLENDS (57) Abstract A fuel blend composition including a hydrocarbon liquid as defined, up to 20 % of the total composition of ethanol and/or n-propanol and up to 15 % by volume of the total composition of a fatty acid and/or organic ester. | | |

FUEL BLENDS

Field of the Invention

This invention relates to fuel blend compositions including a hydrocarbon liquid, low-alkyl alcohol and fatty acid and/or organic ester. Additionally, the invention relates to a fuel
5 additive composition including a low-alkyl alcohol and fatty acid and/or organic ester.

Background to the Invention

Diesel oil, due to its cost and availability, continues to be the backbone for industry around the world being the principal fuel for use in trucks, ships, trains, some cars and other automotive equipment and different stationary types of engines.

- 10 It is well recognised that the combustion of diesel fuel in engines can be hazardous to the environment. In particular, the partial combustion of diesel fuel to carbon, carbon monoxide, and nitrogen oxides creates noxious black exhaust gases which are pollutants. This problem is particularly observable in trucks and other automotive vehicles where noxious black exhaust gases can be seen being released into the environment.
- 15 Attempts have been made over the years to address the environmental concerns associated with exhaust fumes from engines by using alcohols such as methanol (methyl alcohol) or ethanol (ethyl alcohol) as fuels. Such attempts, for instance, have generally established that 15% of ethanol and 85% diesel oil provides an acceptable burning capacity without the necessity of modifying existing diesel engines.
- 20 The problem with using ethanol or methanol as a fuel in conjunction with diesel oil is that ethanol or methanol are immiscible with diesel oil, that is, they cannot be uniformly mixed or blended into one phase without rapid separation into their component parts. Since they cannot be uniformly mixed into one phase and stored for easy use, the components must be mixed just prior to use by, for example, having independent fuel tanks with the
- 25 components independently pumped and mixed just before the combined fuel is injected into the fuel chamber. Such a system is currently being used in the bus fleet of the Des Moines Transit Authority, Iowa, USA.

One attempt to address the problem of immiscibility was to form an emulsion of the diesel oil and ethanol using an emulsifier. An example of this is in Australian Patent No. 544,728
30 which discloses a composition having 84.5% diesel oil, 15% hydrated ethanol and 0.5% emulsifier. The emulsifier is of the styrene butadiene co-polymer type in admixture with a high molecular weight polyethylene glycol dissolved in xylene. This mixture can show both batch to batch variation and instability as the diesel and ethanol separate in the fuel tank.

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An attempt has also been made to address the problem of immiscibility by forming a blend comprising a petroleum fuel, methanol and a higher alcohol having 10-16 carbon atoms as a solvent for the petroleum fuel and methanol. An example of this is disclosed in U.S. Patent No. 4,527,995.

10 A further attempt to address the problem of immiscibility is disclosed in the UK Patent Application No. GB 2,090,611 where combustible compositions are claimed containing gas oils, methanol and a fatty acid for use in diesel engines. The claimed combustible compositions comprises from 20% to 90% by volume of at least one gas oil, from 5% to 50% by volume of methanol and from 5% to 60% by volume of at least one (C₁-C₃) alkyl ester of a (C₆-C₂₂) saturated or unsaturated fatty acid. The specification states that alcohols heavier than methanol such as butanol must be added in substantial portions and do not improve the cetane number.

20 The article entitled "Diesel Oil substitution by Processed Plant Oils - Engine and Vehicle Results" published in 1982 by two authors from Volkswagen do Brasil S.A. Brazil, compare tests conducted using a straight methyl ester of soya bean oil (MESO) as a fuel with a 75-25 gasoil-MESO blend and a 68-23-9 gasoil-MESO-ethanol(anhydrous) blend. The article provides that plant-oil mono-esters used as gasoil extenders serve as co-solvents between gasoil and ethanol, thus permitting ready use of otherwise-incompatible ethanol. However, the article provides that an increase in proportion of ester in the gasoil from a 25% ester content onwards results in the ethanol being substantially compatible in the gasoil.

In subsequent investigations leading to the present invention, it has surprisingly been found that fatty acids and/or organic esters having up to 15% by volume in the fuel blend composition function as a coupling agent between the hydrocarbon liquid and ethanol and/or n-propanol to form a single phase composition which is not prone to separation.

Summary of the Invention

30 According to a first embodiment of the invention, there is provided a single phase fuel blend

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composition including at least 65% of a hydrocarbon liquid selected from the group consisting of diesel fuel, gas oil or mixtures thereof, not in excess of 20% by volume of the total composition of an alcohol component which is exclusively selected from the light alcohols ethanol, n-propanol and mixtures thereof, and not in excess of 15% by volume of the total composition of a coupling agent which is an organic ester.

In a preferred embodiment of the invention, the coupling agent further includes a fatty acid.

10 In a preferred embodiment of the invention, the coupling agent is between 1.5% and 11% by volume.

In another preferred embodiment of the invention, the coupling agent is between 2% and 5% by volume.

Preferably, the organic ester is selected from the group consisting of fatty acid esters, aromatic esters, aliphatic esters and any mixtures thereof.

20 The fatty acid esters are derived preferably from natural oils and fats such as lard, tallow and vegetable oils, for example, canola, palm, corn, sunflower and soya bean oils or from specific blends commercially produced by fatty acid manufacturers or from fatty acids made by synthetic means or mixtures thereof. The fatty acid is preferably "oleic acid". For those skilled in the art, this is understood to mean the commercially available liquid fatty acids in which the mono-unsaturated fatty acid is significantly present.

The organic ester component is selected preferably from fatty esters such as ethyl oleate, ethyl tallowate, iso-propyl oleate, butyl oleate, methyl oleate or methyl cocoate and/or other aromatic esters such as butyl benzoate and/or other aliphatic esters such as ethyl acetate or mixtures thereof and/or dicarboxylic acid esters such as dioctyl maleate.

30 In a preferred embodiment of the invention, the hydrocarbon liquid (as hereinafter defined)

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component is between 75% and 88% by volume of the total composition.

The term hydrocarbon liquid, as used in the specification, means diesel oil and gas oil and mixtures thereof.

According to a preferred embodiment of the invention, there is provided a process for producing a single phase fuel blend composition including the steps of:

- 10 (a) adding the alcohol component to the hydrocarbon liquid to form a mixture at the alcohol phase and an oil phase and thereafter;
- (b) adding the mixture of step (a) to the coupling agent; and
- (c) mixing the resultant mixture until a single phase has been formed.

According to a further embodiment of the invention, there is provided a fuel additive composition including an alcohol component which is exclusively selected from the light alcohols ethanol, n-propanol and mixtures thereof and an organic ester in respective amounts ranging from a ratio of 25:1 to 1:1. Up to 35% of the fuel additive composition is added to the hydrocarbon liquid to form a single phase composition.

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In a further preferred embodiment of the invention, a process to produce a single phase fuel blend composition is provided by:

- (a) adding the alcohol component to the coupling agent to form the additive composition and thereafter;
- (b) adding the mixture of (a) to the hydrocarbon liquid; and
- (c) mixing the resultant mixture until a single phase has been formed.

Examples

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The carboxylate esters used in the examples are those manufactured at the premises of the Victorian Chemical Co., Richmond Victoria Australia and are sold under the "Esterol" brand name. The ethyl acetate was purchased from BP Chemicals Australia. The diesel oil is that

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purchased from pumps of major Australian oil companies such as Caltex Petroleum Pty Ltd.

The ethanol (ethyl alcohol) is commercial material obtained from the CSR Distilleries, Yarraville Victoria Australia and is known as Ethanol 100SG/F3 (trade mark) which contains 3% methanol.

The following is a non-limiting example of a process to produce Composition 1 below according to the invention.

10

Diesel oil (85ml) is placed in a 100ml bottle at ambient temperature and pressure. Ethanol (10.0ml) is added to the bottle creating an oil phase and an alcohol phase. Methyl oleate (5.0ml) is then added, a stopper applied to the top of the bottle and the resultant mixture is shaken for a period of approximately 30 seconds or such less or further period of time to allow proper mixing of the liquids to take place and a single phase to form. The mixture was allowed to stand to allow the contents to settle. A single phase is observed.

Substantially the same method is used to produce the other compositions detailed below.

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Product blends were made (as percentage v/v) as follows:

Composition 1

| | |
|---------------|------------|
| Diesel Oil | 85.0 |
| Ethanol | 10.0 |
| Methyl Oleate | <u>5.0</u> |
| | 100.0 |

Composition 2

| | |
|--------------|--------------|
| Diesel Oil | 80.0 |
| n-Propanol | 13.5 |
| Methanol | 1.5 |
| Ethyl Oleate | <u>5.0</u> |
| | <u>100.0</u> |

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Composition 3

| | |
|---------------|--------------|
| Diesel Oil | 80.0 |
| Ethanol | 15.0 |
| Ethyl Acetate | <u>5.0</u> |
| | <u>100.0</u> |

5

Composition 4

| | |
|-----------------|--------------|
| Diesel Oil | 80.0 |
| Ethanol | 15.0 |
| Ethyl Tallowate | <u>5.0</u> |
| | <u>100.0</u> |

10

Composition 5

| | |
|----------------|--------------|
| Diesel Oil | 82.0 |
| Ethanol | 15.0 |
| Butyl Benzoate | <u>3.0</u> |
| | <u>100.0</u> |

15

Composition 6

| | |
|------------|--------------|
| Diesel Oil | 82.0 |
| Ethanol | 15.0 |
| Oleic Acid | <u>3.0</u> |
| | <u>100.0</u> |

20

Composition 7

| | |
|--------------|--------------|
| Diesel Oil | 83.0 |
| Ethanol | 13.5 |
| Iso-Propanol | 1.5 |
| Ethyl Oleate | <u>2.0</u> |
| | <u>100.0</u> |

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Composition 8

| | | |
|---|-----------------|--------------|
| | Diesel Oil | 81.0 |
| | Ethanol | 15.0 |
| | Ethyl Tallowate | 1.5 |
| 5 | Ethyl Acetate | <u>2.5</u> |
| | | <u>100.0</u> |

Composition 9

| | | |
|----|----------------|------------|
| | Diesel Oil | 80 |
| 10 | Ethanol | 14 |
| | Methanol | 1 |
| | Ethyl Oleate | 4 |
| | Butyl Benzoate | <u>1</u> |
| | | <u>100</u> |

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Composition 10

| | | |
|----|-------------------|--------------|
| | Gas Oil | 74.5 |
| | Ethanol | 20.0 |
| | Oleic Acid | 3.0 |
| 20 | Iso-Propyl Oleate | <u>2.5</u> |
| | | <u>100.0</u> |

Composition 11

| | | |
|----|--------------|--------------|
| | Diesel Oil | 87.75 |
| 25 | Ethanol | 9.0 |
| | Ethyl Oleate | <u>3.25</u> |
| | | <u>100.0</u> |

Composition 12

| | | |
|----|--------------|------------|
| 30 | Diesel Oil | 94 |
| | Ethanol | 5 |
| | Ethyl Oleate | <u>1</u> |
| | | <u>100</u> |

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Composition 13

| | |
|--------------|--------------|
| Diesel Oil | 94.5 |
| Ethanol | 5.0 |
| Ethyl Oleate | <u>0.5</u> |
| | <u>100.0</u> |

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Composition 14

| | |
|--------------|--------------|
| Diesel Oil | 94.8 |
| Ethanol | 5.0 |
| Ethyl Oleate | <u>0.2</u> |
| | <u>100.0</u> |

10

Composition 15

| | |
|--------------|------------|
| Diesel Oil | 80 |
| Ethanol | 10 |
| Ethyl Oleate | 5 |
| n-Butanol | <u>5</u> |
| | <u>100</u> |

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Composition 16

| | |
|--------------|------------|
| Diesel Oil | 79 |
| Ethanol | 10 |
| Ethyl Oleate | 6 |
| Iso-Propanol | <u>5</u> |
| | <u>100</u> |

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Composition 17

| | |
|--------------|------------|
| Diesel Oil | 74 |
| Ethanol | 15 |
| Ethyl Oleate | <u>11</u> |
| | <u>100</u> |

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Composition 18

| | | |
|---|------------|--------------|
| | Diesel Oil | 94.8 |
| | Ethanol | 5.0 |
| | Oleic Acid | <u>0.2</u> |
| 5 | | <u>100.0</u> |

Composition 19

| | | |
|----|------------|------------|
| | Diesel Oil | 94 |
| | Ethanol | 5 |
| 10 | Oleic Acid | <u>1</u> |
| | | <u>100</u> |

Composition 20

| | | |
|----|------------|--------------|
| | Diesel Oil | 88.5 |
| | Ethanol | 10.0 |
| 15 | Oleic Acid | <u>1.5</u> |
| | | <u>100.0</u> |

Composition 21

| | | |
|----|------------|------------|
| | Diesel Oil | 82 |
| | Ethanol | 15 |
| 20 | Oleic Acid | <u>3</u> |
| | | <u>100</u> |

Composition 22

| | | |
|----|--------------|--------------|
| | Diesel Oil | 81.5 |
| | Ethanol | 15.0 |
| | Ethyl Oleate | <u>3.5</u> |
| 25 | | <u>100.0</u> |

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Composition 23

| | |
|------------|------------|
| Diesel Oil | 76 |
| Ethanol | 20 |
| Oleic Acid | <u>4</u> |
| | <u>100</u> |

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Composition 24

| | |
|------------------|--------------|
| Diesel Oil | 74.5 |
| Ethanol | 20.0 |
| Oleic Acid | 3.0 |
| Isopropyl Oleate | <u>2.5</u> |
| | <u>100.0</u> |

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Composition 25

| | |
|----------------|------------|
| Diesel Oil | 70 |
| Ethanol | 15 |
| Methyl Cocoate | <u>15</u> |
| | <u>100</u> |

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Composition 26

| | |
|----------------|------------|
| Diesel Oil | 77 |
| Ethanol | 15 |
| Methyl Cocoate | <u>8</u> |
| | <u>100</u> |

20

Composition 27

| | |
|----------------|------------|
| Diesel Oil | 75 |
| Ethanol | 15 |
| Methyl Cocoate | <u>10</u> |
| | <u>100</u> |

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Composition 28

| | | |
|---|--------------|--------------|
| | Diesel Oil | 78.5 |
| | Ethanol | 0.5 |
| | Ethyl Oleate | 6.5 |
| 5 | n-Propanol | <u>14.5</u> |
| | | <u>100.0</u> |

Composition 29

| | | |
|----|---------------|------------|
| | Diesel Oil | 85 |
| | Ethanol | 10 |
| 10 | Methyl Oleate | <u>5</u> |
| | | <u>100</u> |

Composition 30

| | | |
|----|---------------|--------------|
| | Diesel Oil | 77.5 |
| | Ethanol | 15.0 |
| | Ethyl Oleate | 5.0 |
| 15 | Ethyl Acetate | <u>2.5</u> |
| | | <u>100.0</u> |

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Composition 31

| | | |
|----|------------------|------------|
| | Diesel Oil | 77 |
| | Ethanol | 15 |
| | Diocetyl maleate | 8 |
| 25 | | <u>100</u> |

Composition 32

| | | |
|----|--------------|------------|
| | Diesel Oil | 65 |
| | Ethanol | 20 |
| | Ethyl Oleate | <u>15</u> |
| 30 | | <u>100</u> |

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Composition 33

| | |
|--------------|------------|
| Diesel Oil | 67 |
| Ethanol | 18 |
| Ethyl Oleate | <u>15</u> |
| | <u>100</u> |

10 All of the above Compositions had a single phase demonstrating the effectiveness of the use of levels of fatty acids and/or organic esters or mixtures thereof to blend hydrocarbon liquids such as diesel oil and low-alkyl alcohols such as ethanol into one phase. These compositions were tested over the typical temperatures in which normal fuels are to perform and were not found to be temperature sensitive.

In each of the Components listed above, the blend of diesel oil and low alkyl alcohol is in one phase and the blend was found to operate satisfactorily as a fuel.

20 **Volkswagon Engine:** A 1979 Volkswagon "Golf" (trade mark) 4 cylinder 1.5 litre diesel engine was tested over several months on Composition No. 15. The engine was tested under normal operation conditions and no decrease in either power or fuel efficiency was noticed.

Prime Mover Engine: A modern Mercedes Benz prime Mover Engine Type 2228V Series (trade mark) was tested on Composition No. 4, under typical 40 tonne loads. There was no noticeable decrease in either power or fuel efficiency of the engine.

30 **Fork Lift Engine:** A 4 cylinder Yale Forklift (Model GDP 050 RUAS (trade mark) (with a) 44HP (2400 rpm) Mazda XA (trade mark) series diesel motor engine was tested under typical warehouse operating conditions on Composition Nos. 15 and 21 over several months. As well as no difference being noted in the efficiency of the fork lift engine, the use of the ethanol blend is likely to be more acceptable in the enclosed warehouse atmosphere.

In respect of each of the above compositions, a fuel additive composition can be formed of the

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low-alkyl alcohol and the fatty acid and/or organic ester which may be added to the hydrocarbon liquids.

Fuel Additive Compositions:

The Additive Composition is illustrated by the following non-limiting examples. The following is a non-limiting example of a process to produce Additive Composition 1 below according to the invention.

10

Ethanol (66.7ml) is placed in a 100ml bottle at ambient temperature and pressure. Methyl Oleate (33.3ml) is added to the bottle to form a clear Additive Composition 1. Additive Composition 1 (15ml) is then added to the diesel oil (85ml), a stopper applied to the top of the bottle and the resultant mixture is shaken for a period of approximately 30 seconds or

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less or for the period of time to allow proper mixing of the liquids to take place and a single phase to form.

Substantially the same method is used to produce other Additive Compositions as detailed below.

- 5 Additive Compositions were made (as percentages v-v) as follows:

Additive Composition 1

| | | |
|----|---------------|--------------|
| | Ethanol | 66.7 |
| | Methyl Oleate | <u>33.3</u> |
| 10 | | <u>100.0</u> |

Additive Composition 1 (15 ml) was added to diesel oil (85 ml).

Additive Composition 2

| | | |
|----|-----------------|------------|
| | Ethanol | 75 |
| | Ethyl Tallowate | <u>25</u> |
| 15 | | <u>100</u> |

Additive Composition 2 (20 ml) was added to diesel oil (80 ml).

Additive Composition 3

| | | |
|----|--------------|--------------|
| | Ethanol | 79.4 |
| | Ethyl Oleate | 11.8 |
| 20 | Iso Propanol | <u>8.8</u> |
| | | <u>100.0</u> |

Additive Composition 3 (17 ml) was added to diesel oil (83 ml).

Additive Composition 4

| | | |
|---|-----------------|--------------|
| | Ethanol | 78.9 |
| | Ethyl Acetate | 13.2 |
| | Ethyl Tallowate | <u>7.9</u> |
| 5 | | <u>100.0</u> |

Additive Composition 4 (19 ml) was added to diesel oil (81 ml).

Additive Composition 5

| | | |
|----|--------------|------------|
| | Ethanol | 50 |
| | Ethyl Oleate | 25 |
| 10 | n Butanol | <u>25</u> |
| | | <u>100</u> |

Additive Composition 5 (20 ml) was added to diesel oil (80 ml).

Additive Composition 6

| | | |
|----|------------|--------------|
| | Ethanol | 83.3 |
| 15 | Oleic Acid | <u>16.7</u> |
| | | <u>100.0</u> |

Additive Composition 6 (24 ml) was added to diesel oil (76 ml).

Additive Composition 7

| | | |
|----|-------------------|--------------|
| | Ethanol | 78.4 |
| 20 | Oleic Acid | 11.8 |
| | Iso Propyl Oleate | <u>9.8</u> |
| | | <u>100.0</u> |

Additive Composition 7 (25.5 ml) was added to diesel oil (74.5 ml).

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Additive Composition 8

| | |
|----------------|------------|
| Ethanol | 50 |
| Methyl Cocoate | <u>50</u> |
| | <u>100</u> |

- 5 Additive Composition 8 (30 ml) was added to diesel oil (70 ml).

Additive Composition 9

| | |
|---------------|--------------|
| Ethanol | 66.7 |
| Ethyl Acetate | 11.1 |
| Ethyl Oleate | <u>22.2</u> |
| | <u>100.0</u> |

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- Additive Composition 9 (22.5 ml) was added to diesel oil (77.5 ml).

Additive Composition 10

| | |
|--------------|--------------|
| Ethanol | 57.2 |
| Ethyl Oleate | <u>42.8</u> |
| | <u>100.0</u> |

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- Additive Composition 10 (35 ml) was added to diesel oil (65 ml).

The resultant mixtures were allowed to stand to allow the contents to settle. All of the resultant mixtures had a single phase throughout the typical temperature range in which normal fuels are to perform and were found not to be temperature sensitive.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A single phase fuel blend composition including at least 65% of a hydrocarbon liquid selected from the group consisting of diesel fuel, gas oil or mixtures thereof; not in excess of 20% of the total composition of an alcohol component which is exclusively selected from the light alcohols ethanol, n-propanol and mixtures thereof; and not in excess of 15% by volume of the total composition of a coupling agent which is an organic ester.
 2. A single phase fuel blend composition according to claim 1 wherein the coupling agent further includes a fatty acid.
 3. A single phase fuel blend composition according to either of the claims 1 or 2 wherein the organic ester is selected from the group consisting of fatty acid esters, aromatic esters, aliphatic esters and any mixtures thereof.
 4. A single phase fuel blend composition according to claim 3 wherein the fatty acid ester is derived from natural oils and fats or vegetable oils or is produced by synthetic means or any mixtures thereof.
 5. A single phase fuel blend composition according to claim 4 wherein the natural oils and fats are lard and tallow.
 6. A single phase fuel blend composition according to claim 4 wherein the vegetable oils are derived from canola, palm, corn, rape, sunflower oil or soya bean oils.
 7. A single phase fuel blend composition according to claim 3 wherein the fatty acid ester is selected from ethyl oleate, methyl oleate, ethyl tallowate, isopropyl oleate, butyl oleate or methyl cocoate.
 8. A single phase fuel blend composition according to claim 3 wherein the aromatic ester is butyl benzoate.
 9. A single phase fuel blend composition according to claim 3 wherein the aliphatic ester is ethyl acetate.
 10. A single phase fuel blend composition according to any one of claims 1 to 9, additionally including a dicarboxylic acid ester.
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11. A single phase fuel blend composition according to claim 10 wherein the dicarboxylic acid ester is dioctyl malcate.
12. A single phase fuel blend composition according to any one of claims 1 to 11 wherein coupling agent is between 1.5% - 11% by volume of the total composition.
13. A single phase fuel blend composition according to claim 12 wherein the coupling agent is between 2% - 5% by volume of the total composition.
14. A single phase fuel blend composition according to any of the previous claims wherein the hydrocarbon liquid is between 75% - 85% by volume of the total composition.
15. A process for producing a single phase fuel blend composition according to any one of claims 1 to 14 including the steps of:
 - (a) adding the alcohol component to the hydrocarbon liquid to form an alcohol phase and an oil phase; thereafter
 - (b) adding the mixture of step (a) to the coupling agent; and
 - (c) mixing the resultant mixture until a single phase is formed.
16. A process for producing a single phase fuel blend composition according to any one of claims 1 to 14 including the steps of:
 - (a) adding the alcohol component to the coupling agent; thereafter
 - (b) adding the mixture of step (a) to the hydrocarbon liquid; and
 - (c) mixing the resultant mixture until a single phase is formed.
17. A miscible one phase composition consisting essentially of:
 - (a) at least 65% by volume of the total composition of a hydrocarbon liquid selected from the group consisting of diesel oil, gas oil and mixtures thereof,
 - (b) not in excess of 20% by volume of the total composition of an alcohol component selected from the group consisting of ethanol, n-propanol and mixtures thereof, and
 - (c) not in excess of 15% by volume of the total composition of a coupling agent consisting of oleic acid and an organic ester

component selected from the group consisting of C1-C4 alkyl esters of fatty acids, selected from the group consisting of oleic acid, tallow fatty acids and coconut fatty acids and mixtures thereof;

wherein the fatty acid in the ester of a fatty acid is derived from natural oils and fats or synthetic oils or any mixtures thereof; and

wherein the alcohol component and the coupling agent are present in respective amounts of from about 25:1 to about 1:1.

18. A fuel additive composition for and miscible with a hydrocarbon selected from the group consisting of diesel oil, gas oil and mixtures thereof consisting essentially of (a) an alcohol component selected from the group consisting of ethanol, n-propanol and mixtures thereof and (b) a coupling agent consisting of oleic acid and an organic ester selected from the group consisting of C1-C4 alkyl esters of fatty acids selected from the group consisting of oleic acid, tallow fatty acids and coconut fatty acids and mixtures thereof, wherein the fatty acids in the ester of a fatty acid is derived from natural oils and fats or synthetic oils or any mixtures thereof, and wherein the alcohol component and the coupling agent are present in respective amounts ranging from a ratio of about 25:1 to 1:1.



European Patent
Office

**SUPPLEMENTARY
EUROPEAN SEARCH REPORT**

Application Number
EP 94 92 1537

| DOCUMENTS CONSIDERED TO BE RELEVANT | | | |
|---|---|--|---|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int.Cl.6) |
| X | US-A-4 405 337 (YANMAR DIESEL ENGINE CO) * claims 1,2,4 * * column 2, line 52 - line 54 * * column 2, line 62 - line 64 * * examples 1-6 * ----- | 1,2,4,7, 13, 15-18,20 | C10L1/02 C10L1/10 C10L1/18 |
| | | | TECHNICAL FIELDS SEARCHED (Int.Cl.6) C10L |
| The supplementary search report has been drawn up for the claims attached hereto. | | | |
| Place of search THE HAGUE | | Date of completion of the search 6 June 1996 | Examiner De Herdt, O |
| CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document | | | |

The claims defining the invention are as follows:

1. A fuel blend composition including a hydrocarbon liquid as hereinbefore defined, up to 20% of the total composition of ethanol and/or n-propanol and up to 15% by volume of the total composition of a fatty acid and/or organic ester.
- 5 2. A fuel blend composition according to claim 1 wherein the fatty acid and/or organic ester component is between 1.5% - 11% by volume of the total composition.
3. A fuel blend composition according to claim 1 wherein the fatty acid and/or organic ester component is between 2% - 5% by volume of the total composition.
- 10 4. A fuel blend composition according to any of claims 1 to 3 wherein the fatty acid is derived from natural oils and fats or vegetable oils or is produced by synthetic means or any mixtures thereof.
5. A fuel blend composition according to claim 4 wherein the natural oils and fats are lard and tallow.
- 15 6. A fuel blend composition according to claim 4 wherein the vegetable oils are derived from canola, palm, corn, sunflower oil or soya bean oils.
7. A fuel blend composition according to any of the claims 1 to 3 wherein the organic ester is selected from fatty acids, aromatic esters and/or aliphatic esters and any mixtures thereof.
- 20 8. A fuel blend composition according to claim 7, additionally including a dicarboxylic acid ester.
9. A fuel blend composition according to claim 7 wherein the fatty acids are selected from ethyl oleate, methyl oleate, ethyl tallowate, iso-propyl oleate, butyl oleate, methyl oleate or methyl cocoate.
- 25 10. A fuel blend composition according to claim 7 wherein the aromatic esters are selected from butyl benzoate and ethyl acetate.
11. A fuel blend composition according to claim 7 wherein the dicarboxylic acid ester is dioctyl maleate.
12. A fuel blend composition according to any of the previous claims further including methanol, iso-propanol, butanol, iso-butanol, tertiary butanol and mixtures thereof.
- 30 13. A fuel blend composition according to any of the previous claims wherein the hydrocarbon liquid is at least 40% by volume of the total composition.
14. A fuel blend composition according to any of the previous claims wherein the hydrocarbon liquid is between 75% - 85% by volume of the total composition.

15. A process for producing a single phase fuel blend composition according to any one of claims 1 to 14 including the steps of:
- a) adding the ethanol and/or n-propanol alcohol to the hydrocarbon liquid to form an alcohol phase and an oil phase; thereafter
 - 5 (b) adding the mixture of step (a) to the fatty acid and/or organic ester ; and
 - (c) mixing the resultant mixture until a single phase is formed.
16. A process for producing a single phase fuel blend according to any one of claims 1 to 14 including the steps of:
- 10 (a) adding the ethanol and/or n-propanol to the fatty acid and/or organic ester; thereafter
 - (b) adding the mixture of step(a) to the hydrocarbon liquid ; and
 - (c) mixing the resultant mixture until a single phase is formed;
17. A fuel blend composition as hereinbefore described by reference to any of the examples.
- 15 18. A fuel additive composition including ethanol and/or n-propanol and a fatty acid and/or organic ester in respective amounts ranging from a ratio of 25:1 to 1:1.
19. A fuel blend composition including the hydrocarbon liquid and up to 35% of the fuel additive composition as in claim 18.
20. A fuel additive composition as hereinbefore described by reference to any of the examples.
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